



ICESat (GLAS) Science Processing Software Document Series

**The GLAS Standard Data Products Specification—
Level 2, Version 9**

Jeffrey E. Lee

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Space Administration

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Level 2, Version 9**

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Foreword

The GEOSCIENCE LASER ALTIMETER SYSTEM (GLAS) is the primary instrument for the ICESat (Ice, Cloud and Land Elevation Satellite) laser altimetry mission. ICESat is the benchmark Earth Observing System (EOS) mission for measuring ice sheet mass balance, cloud and aerosol heights, as well as land topography and vegetation characteristics. From 2003 to 2009, the ICESat mission provided multi-year elevation data needed to determine ice sheet mass balance as well as cloud property information, especially for stratospheric clouds common over polar areas. It also provided topography and vegetation data around the globe, in addition to the polar-specific coverage over the Greenland and Antarctic ice sheets.

This document defines the Level 2 GLAS standard data products. This Standard Data Products Specification is developed under the structure of the NASA STD-2100-91, a NASA standard defining a four-volume set of documents to cover an entire software life cycle. Under this standard a section of any volume may, if necessary, be rolled out to its own separate document. This document is a roll out of the GLAS ESDIS Software Detailed Design Specification under the Product Specification Volume.

This document addresses the data flow, interfaces, record and data formats associated with the GLAS Level 2 standard data products. The term “standard data products” refers to those EOS instrument data products listed in the Earth Science Data and Information System (ESDIS) Project data base that are routinely generated within the EOSDIS Distributed Active Archive Center (DAAC) or Science Computing Facilities (SCFs). Each data product has a unique Product Identification code assigned by the Senior Project Scientist.

The Level 2 Standard Data Products specifically include those derived geophysical data values (i.e., ice sheet elevation, cloud height, vegetation height, etc.). Additionally, the appropriate correction elements used to transform the Level 1A and Level 1B Data Products into Level 2 Data Products are included. The data are packaged with time tags, precision orbit location coordinates, and data quality and usage flags.

This document was prepared by the Cryospheric Sciences Laboratory at NASA Goddard Space Flight Center, in support of B. E. Schutz, GLAS Science Team Leader for the GLAS Investigation. This work was performed under the direction of David W. Hancock, III, who may be contacted at (757) 824-1238, David.W.Hancock@nasa.gov (e-mail), or (757) 824-1036 (FAX).

This document was created through the efforts of the GLAS Science Algorithm Software (GSAS) Development Team. Current team members include:

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Section 1

Introduction

1.1 Identification of Document

This document is identified as the GLAS Level 2 Standard Data Products Specification (SDPS-L2). The unique document identification number within the GLAS Standard Data Software documentation numbering scheme is GLAS-DPS-2641. This edition marks the final release of this document

1.2 Scope of Document

This document addresses the purpose, usage, and description of the GLAS Level 2 Standard Data Products. The intended audience for this document is the GLAS Science and Instrument Teams, the ESDIS Project and related focus teams, the community of EOS data users and investigators, and the GSAS Development Team.

1.3 Purpose and Objectives of Document

The purpose of the GLAS Level 2 Standard Data Products Specification is to provide a high-level descriptive document for the data products. This document describes the purpose, usage, content, and format of the GLAS Level 2 Data Products. It further describes the structure, physical storage, organization, and access characteristics of the GLAS Level 2 Data Products. The document additionally describes file transfer methods to support product access, the data flow associated with the data product, and the data storage and generation characteristics of the data product.

1.4 Document Organization

This document's outline is assembled in a form similar to those presented in the NASA Software Engineering Program [Applicable Document 2.3a].

1.5 Document Status and Schedule

This is the final edition of this document.

1.5.1 Document Change History

Document Name: GLAS Standard Data Products Specification - Level 2		
Version Number	Date	Nature of Change
Preliminary	December 31, 1995	Original Version

Document Name: GLAS Standard Data Products Specification - Level 2		
Version Number	Date	Nature of Change
Version 1.2	March 1998	Text, Figures, and Tables updated for Level 2 data updates, for the change to GLAS standard data product generation being performed at the GLAS SCF, and change of the spacecraft name to ICESAT.
Version 2.0	January 1999	Updates to the data product contents.
Version 3.0	November 2000	Updated Data Product Contents coincident with the GLAS Science Algorithm Software V1 release.
Version 4.0	November 2001	Updated Data Product Contents coincident with the GLAS Science Algorithm Software V2 release.
Version 5.0	July 2002	Updated Data Product Contents coincident with the GLAS Science Algorithm Software V2.2 release.
Version 6.0	October 2002	Revised for Version 3.0 software.
Version 7.0	August 2004	Revised for Version 4.0 software.
Version 8.0	November 2005	Revised for Version 5.0 software.
Version 9.0	August 2012	Revised for Version 6.0 software. Final Release.

Related Documentation

2.1 Parent Documents

The GLAS Level 2 Standard Data Products Specification is considered a "roll-out" from the Product Specification as the parent document or volume. Specific topics pertaining to data descriptions are located in the External Interface sections under the Detailed Design document template.

This document is subordinate to any top-level mission or instrument management plan documents, and as such, recognizes these documents as external parent documents in lineage. The recognized external EOSDIS and GLAS parent documents superior to this document are listed below.

- a) *NASA Earth Observing System Geoscience Laser Altimeter System GLAS Science Requirements Document*, Version 2.01, October 1997, Center for Space Research, University of Texas at Austin.
- b) *GLAS Science Software Management Plan*, NASA/TM-1999-208641/Version 3/Volume 1, August 1998, NASA/GSFC Wallops Flight Facility.

2.2 Applicable Documents

The following documents are applicable to, or contain policies or references pertinent to the contents of this document.

- a) *Data Production Software, Data Management, and Flight Operations Working Agreement for GLAS*, TBD, NASA Goddard Space Flight Center.
- b) *Interface Control Document Between the ICESat Science Investigator-led Processing System (I-SIPS) and the National Snow and Ice Data Center (NSIDC)*, June 1999, NASA Goddard Space Flight Center.
- c) *Interface Control Document Between the ICESat Science Investigator-led Processing System (I-SIPS) and the EOS Data and Operations System (EDOS)*, June 1999, NASA Goddard Space Flight Center.
- d) *Interface Control Document Between the I-SIPS/ISF and the CSR*, August 2004, NASA Goddard Space Flight Center.
- e) *The Algorithm Theoretical Basis Document for Level 1A Processing*, NASA/TM-2012-208641 / Volume 5, June 2012, NASA Goddard Space Flight Center, et al.
- f) *The Algorithm Theoretical Basis Document for the GLAS Atmospheric Data Products*, NASA/TM-2012-208641 / Volume 6, July 2012, NASA Goddard Space Flight Center, et al.
- g) *The Algorithm Theoretical Basis Document for the Derivation of Range and Range Distributions from Laser Pulse Waveform Analysis for Surface Elevations, Roughness,*

Slope, and Vegetation Heights, NASA/TM-2012-208641/Volume 7, August 2012, NASA Goddard Space Flight Center, et al.

- h) *The Algorithm Theoretical Basis Document for the Atmospheric Delay Correction to GLAS Laser Altimeter Ranges*, NASA/TM-2012-208641/Volume 8, NASA Goddard Space Flight Center, et al.
- i) *The Algorithm Theoretical Basis Document for Tidal Corrections*, NASA/TM-2012-208641/Volume 9, Scripps Institution for Oceanography, et al.
- j) *The Algorithm Theoretical Basis Document for Precision Orbit Determination*, 2012, University of Texas Center for Space Research, et al.
- k) *The Algorithm Theoretical Basis Document for Precision Attitude Determination*, 2012, University of Texas Center for Space Research, et al.
- l) *The Algorithm Theoretical Basis Document for Laser Footprint Location (Geolocation) and Surface Profiles*, 2012, University of Texas Center for Space Research, et al.
- m) *GLAS Standard Data Products Specification - Level 1*, NASA/TM-2013-208641/Volume 13, NASA Goddard Space Flight Center, et al.
- n) *GLAS Standard Data Products Specification - Data Dictionary*, NASA/TM-2013-208641/Volume 15, NASA Goddard Space Flight Center, et al.
- o) *GSAS Detailed Design Document*, NASA/TM-2013-208641/Volume 16, NASA Goddard Space Flight Center, et al.
- p) *GSAS User's Guide*, NASA/TM-2013-208641/Volume 17, NASA Goddard Space Flight Center, et al.

2.3 Information Documents

The following documents are provided as sources of information that provide background or supplemental information that may clarify or amplify material in the GLAS Level 2 Standard Data Products Specification.

- a) *NASA Software Documentation Standard Software Engineering Program*, NASA-STD-21000-91, July 29, 1991, NASA.
- b) *The Geoscience Laser Altimetry/Ranging System*, IEEE Transactions on Geoscience and Remote Sensing, Vol. GE-25, No. 5, September 1987.
- c) *EOS Altimetry/GLAS Phase-A Study*, November 1995, NASA Goddard Space Flight Center.
- d) *Memorandum: GLAS Data Products*, December 23, 1993, Center for Space Research, University of Texas at Austin.
- e) *GLAS Science Computing Facility (SCF) Plan*, October 1997, NASA Goddard Space Flight Center, Wallops Flight Facility.

Purpose and Description of the Data Products

3.1 Purpose of the Data Products

The purpose of the GLAS Level 2 Standard Data Products is to provide time-ordered, processed GLAS data, acceptable for science applications. This GLAS derived data consists of calibrated laser altimeter data supplemented with precision orbit determination, earth-location and precision attitude data from the ancillary data sources. The GLAS Level 2 Standard Data Products are intended for use by the GLAS Science Team, and by the EOSDIS data user community. The GLAS Level 2 Data Products are available to the data user community for analysis purposes from the NSIDC DAAC.

3.2 Description of the Data Product

Table 3-1 identifies the Level 2 Data Products. The data products are integer-binary format files containing fixed-length records of data. Each data record consists of several data elements. An element is either an Item or an Array of Items. The elements are measurements and associated correction values obtained from specific GLAS science algorithm sets. The data products are formatted in scaled integer binary format with both attached and unattached metadata containing identification, processing history, and data descriptive information.

Table 3-1 GLAS Level 2 Standard Data Products

Product ID (Identification)	Product Name	Product Level
GLA08	Boundary Layer and Elevated Aerosol Layer Heights File	2
GLA09	Cloud Height for Multiple Layers File	2
GLA10	Aerosol Vertical Structure File	2
GLA11	Thin Cloud/Aerosol Optical Depth File	2
GLA12	Ice Sheet Products File	2
GLA13	Sea Ice Products File	2
GLA14	Land Products File	2
GLA15	Ocean Products File	2

The GLAS Level 2 Standard Data Products are generated as product aggregates or files (i.e., nominally a pass, a half orbit) of GLAS derived geophysical data. The data parameters represent derived geophysical data and associated correction values obtained from specific GLAS science algorithms. These data parameter groups include time tags, data use and quality flags, and precision orbit location data. In addition to the data products, metadata including identification, processing history, and data content descriptive information is produced for archival.

The GLAS Level 2 Standard Data Products are produced by the GLAS Science Algorithm Software which is based on the GLAS Algorithm Theoretical Basis Documents [Applicable Documents 2.2b - 2.2h]. These data products are produced by processing the GLAS Level 1 Data Products to form the Level 2 data. Figure 3-1 illustrates the source data products being processed to generate the Level 2 Data Products.

The specific details of the data product structure, content, format, and data element details will be presented in Section 6. Data sizing and burden, and physical media details are provided in Section 5.

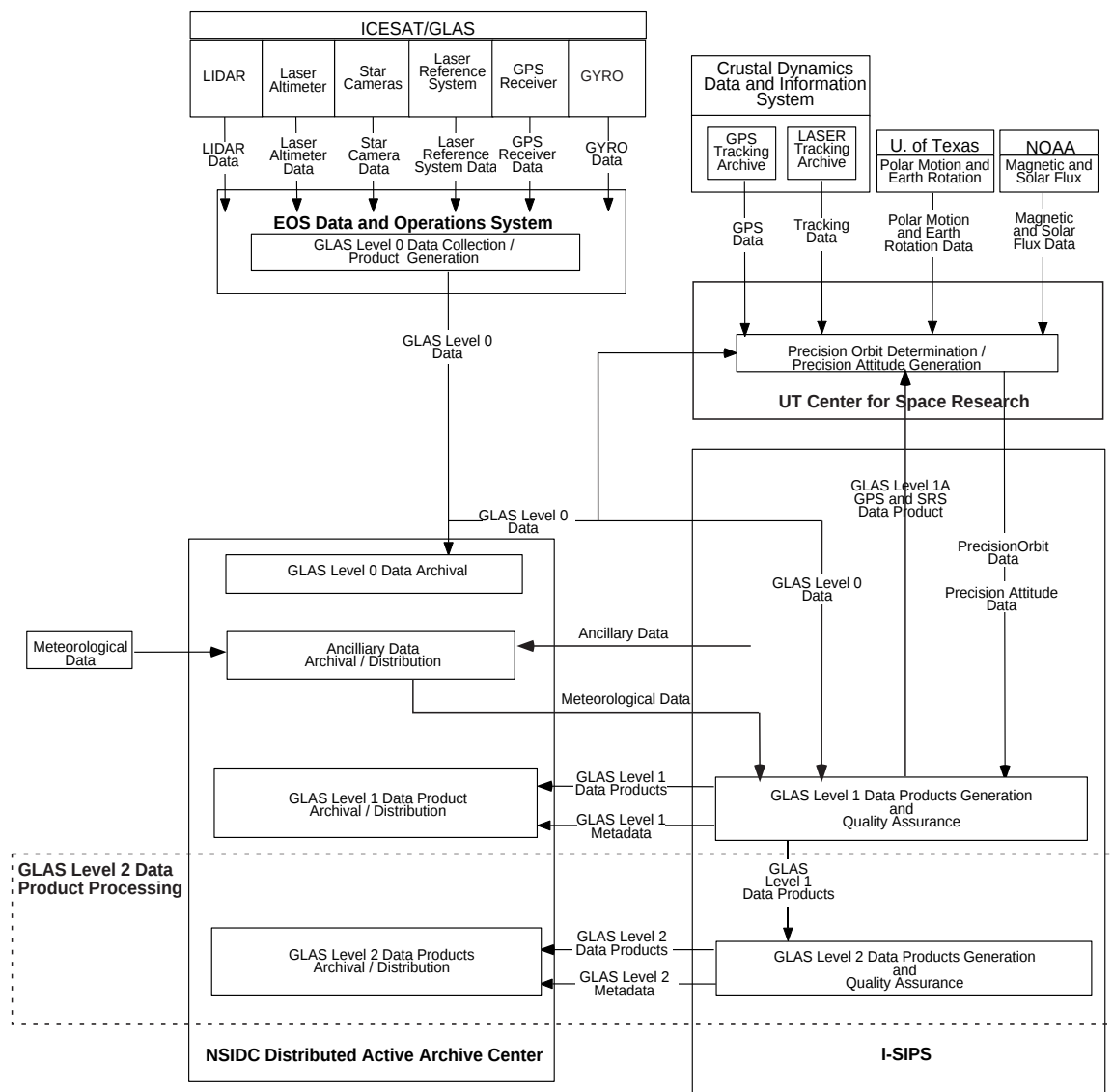


Figure 3-1 GLAS Level 2 Products Within The Data Product Hierarchy

Section 4

Environment

4.1 Hardware Characteristics and Limitations

The GLAS Level 2 Standard Data Products are generated on the Linux host processors within the I-SIPS. The input GLAS Level 1 Data Products and ancillary data reside in the I-SIPS storage facilities. Newly-generated Level 2 Data Products are accessed for quality assurance (QA) monitoring through the I-SIPS.

The I-SIPS consists of multiple Linux-based computers operating under a standard environment in support of GLAS Science Team operations including standard data product generation and quality assurance monitoring. The GLAS Level 2 Data Products and their metadata (including the QA data) are delivered to the National Snow and Ice Data Center (NSIDC) Distributed Active Archive Center (DAAC) archive. The Level 2 metadata (associated data description and support information) are stored in the DAAC to facilitate EOS client inquiry and retrieval activities. The distribution management function of the DAAC allows clients to perform direct search and access of the Level 2 data or to request preparation of Level 2 Data Products.

Some prior versions of the GLAS products were created in a HP/UX big-endian environment. When I-SIPS transitioned to Linux-based little-endian hardware, compiler flags were used to create the products in big-endian format to maintain consistency across product versions. This document describes all products in reference to a big-endian environment.

4.2 Data Product Medium and Characteristics

The Level 2 Data Products are delivered to the DAAC and archived under the Earth Sciences data collection within the DAAC's data storage and archival subsystem as defined in the I-SIPS/NSIDC ICD [Applicable Document 2.2.k]. The storage system will contain not only the Level 2 Data Products, but also the data descriptions and data advertisements (i.e., textual descriptive and abstract information also called metadata). The Level 2 Data Products and their metadata will be part of the Earth Sciences Data Types collection.

The Earth Science data are implemented in EOSDIS system through a hierarchical storage manager interface. Physical media supported by the storage system interface include the disk storage subsystems, magnetic/optical media subsystems, and tiered archive robotics storage subsystems. EOSDIS clients can directly access the GLAS Level 2 data from the DAAC and can copy the data products to their host processors.

The Level 2 Data Products will be available to the GLAS Science Team through the GLAS SCF. See Information Document 2.3.e for a detailed description of the GLAS SCF.

4.3 Protocol and Conventions

Protocols and conventions specific to the GLAS SCF were developed by the GLAS Science Team and documented in the SCF Plan [Information Document 2.3e]. When interfacing to the

DAAC, the I-SIPS complies with procedures, conventions, and protocols as defined by the EOSDIS.

Data definition terminology specific to the GLAS Level 2 Data Products and this document is presented in the Glossary at the end of this document. Figure 4-1 “Data Representation” depicts a schematic of the standard data representations used in GLAS Level 2 Data Products. These data structures are be used in the Section 6.0 product format description and in the associated GLAS Standard Data Products Specification - Data Dictionary [Applicable Document 2.2.a].

Data Types, Sizes, and Representations

Conventions: byte 0 is the most significant byte (MSB)
bit 0 is the least significant bit (lsb)
S = the sign bit

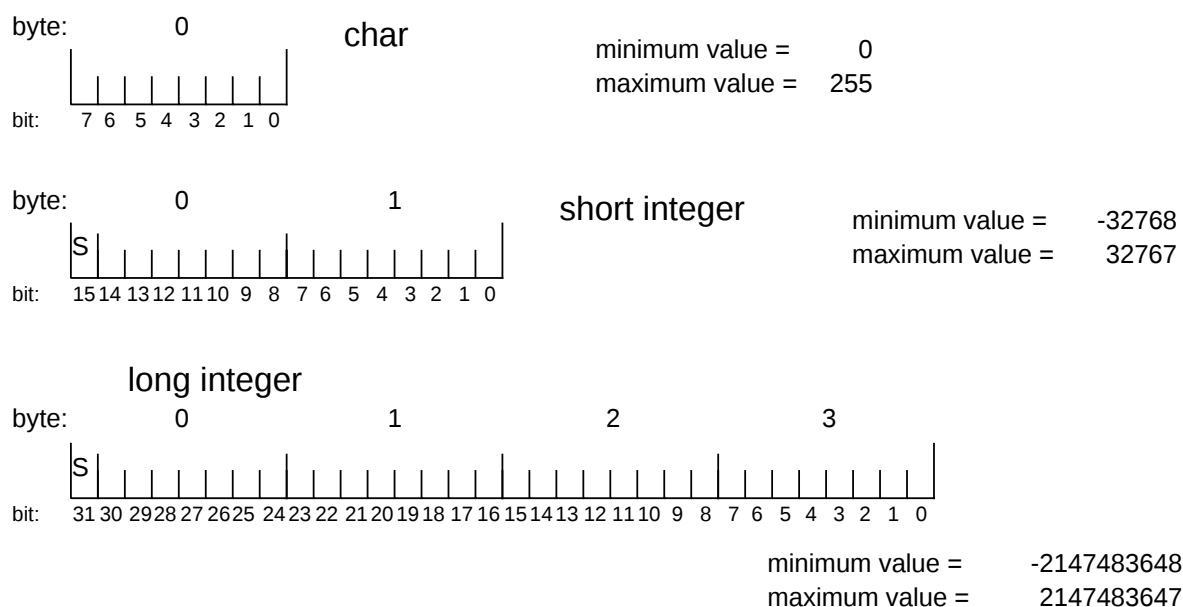


Figure 4-1 Data Representation

4.4 Failure Protection, Detection, and Recovery Features

The team supporting operations at the I-SIPS are responsible for failure protection, detection, and recovery of the generated GLAS Level 2 Data Products stored on the I-SIPS. Initial GLAS Level 2 Data Products error detection is performed during product generation as part of the product and processing quality assurance activity. The GLAS Level 2 Data Products are be “backed up” under the routine operational functions performed at the I-SIPS. In the event of failure or error detection in the active working or archive storage, recovery would be performed from backup media or from the DAAC archive.

The EOSDIS is be responsible for failure protection, detection, and recovery of the GLAS Level 2 Data Products archived at the DAAC.

Data Flow Characteristics

5.1 Volume, Size, and Frequency Estimates

The daily data burdens for the GLAS Level 2 Standard Data Products are listed in Appendix B. This estimate is based on the following operational parameters:

- The spacecraft orbits the Earth at an inclination of 94 degrees and a nominal altitude of 600 kilometers in a circular orbit.
- The orbit (groundtrack) repeat cycle is approximately 91 days based on a frozen orbit.
- The EOS ICESat orbit period is approximately 100 minutes, with a pass period duration of approximately 50 minutes resulting in just under 15 orbits per day.

The daily volumes shown in Appendix B are assuming 24 hours of global coverage for each product. However, the contents of the GLA12, GLA13, GLA14, and GLA15 products will be edited based on location. Therefore the actual daily volume of these products may vary from what is shown in the table.

5.2 Data Transfer and Transmission

The GLAS Data Products and associated descriptive metadata are delivered to the DAAC archival facility through the EOS Science Network. The GLAS Level 2 Data Products delivered to the DAAC processing subsystem are designated for fail-safe function. The GLAS Science Team is provided access to the GLAS Level 2 Data Products through the GLAS SCF using TCP/IP and standard UNIX command operations.

Data access procedures to retrieve GLAS Level 2 Standard Data Products from the DAAC will be provided by the EOSDIS DAAC.

5.3 Timing and Sequencing Characteristics

The GLAS Level 2 Standard Data Products are generated as product files consisting of processed GLAS Level 1A and Level 1B Standard Data Products data. The basic aggregation of the GLAS Level 2 Data Products is the descriptive information in the header records and GLAS Data Elements in the data record. All data records within the GLAS Level 2 Data Products will be in ascending time order based on the height vector or aerosol measurement time tag. All parameters contained within the record are synchronous.

5.4 Recipients and Utilization

The GLAS Science Team and the DAAC are initial recipients of the GLAS Level 2 Data Products. At the I-SIPS, the GLAS Level 2 Data Products are used to produce the metadata quantifying and qualifying the products for EOS community usage. The GLAS Science Team uses the Level 2 Data Products for analysis and research.

The subsequent recipients for the GLAS Level 2 Data Products are the scientific, governmental, and educational community sectors which will obtain the data products from the DAAC.

5.5 Access

The GLAS Level 2 Data Products are available to the GLAS Science Team from the GLAS SCF. Access to the GLAS SCF is controlled by the GLAS Science Team.

The GLAS Level 2 Products are available to the public from the NSIDC DAAC. Procedures for data access are provided by the DAAC.

Section 6

Data Products Definitions

6.1 Data Products Structure

The GLAS Level 2 Standard Data Products, described in Appendix A, will be generated as scaled integer binary files. Each file will include appropriate header, labelling, and metadata information.

6.2 Labeling and Identification

Each of the GLAS Level 2 Data Products is uniquely identified by a GLAS standard file name. The form of this file name is

GLAxx_mmm_prkk_ccc_tttt_s_nn_ffff.eee

Specific elements within the file name are described in Table 6-1.

Table 6-1 GLAS File Naming Keys

Key	Description
xx	The GLAS Product ID (01-15)
mmm	release number for process that created the produce (CCB assigned-combination of software and data)
p	repeat ground track phase
r	reference orbit number
kk	instance # incremented every time GLAS enters a different reference orbit
ccc	cycle of reference orbit for this phase
tttt	track within reference orbit
s	segment of orbit. This is 0 on files that contain multiple segments (GLA02, GLA03, GLA04, GLA07-GLA15) and 1,2,3, or 4 on GLA01, GLA05, and GLA06.
nn	granule version number (the number of times this granule is created for a specific release)
ffff	file type (numerical, CCB assigned for multiple files as needed for data of same time period for a specific ANCxx or GLAxx, i.e. multi-file granule)

The structure and content of the GLAS Data Product headers and labels are contained in the GLAS Standard Data Products Specification - Data Dictionary [Applicable Document 2.2.a].

6.3 Data Products Substructure Descriptions

Full data product descriptions are provided in Appendix B and online in HTML format at the WFF GLAS website. The descriptions are also in the GLAS Standard Data Products Specification - Data Dictionary. The URL for product descriptions is:

http://glas.wff.nasa.gov/prod_format/v60_products/index.html

Table 6-2 lists the fields shown in each data product description entry.

Table 6-2 GLAS Data Product Description Fields

Field	Description
Product ID	GLAS File ID (GLA01, GLA02, etc).
Name	Descriptive name.
Product Level	Product Level (L0,L1A,L1B,L2,L3).
Science Discipline	Primary associated science discipline.
Investigator	Primary investigator.
Archive Site	Location at which this file will be permanently archived.
Source	A flag giving source data system of this file.

Table 6-3 lists the data coverage description fields.

Table 6-3 GLAS Data Coverage Description Fields

Field	Description
Product ID	GLAS File ID (GLA01, GLA02, etc).
Temporal Resolution	Nominal time span, in seconds, of each record of data within a file.
Temporal Coverage	Nominal time span, in minutes, of data contained within a file.
Horiz Res Coverage	Horizontal coverage, in meters, over Earth's surface for each instrument measurement.
Vert Res Coverage	Vertical coverage, in meters, over the Earth's surface for each instrument measurement.
Root/External Flag	A flag signifying whether this file is: 0: neither of the following. 1: the head-of-chain (Level 0 data) of an instrument's data stream. 2: a file from an external source.

Table 6-4 lists the data volume description fields.

Table 6-4 GLAS Data Volume Description of Fields

Field	Description
Product ID	GLAS File ID (GLA01, GLA02, etc).
Frequency (per day)	Number of times processing PGE is executed.
Files per Granule	Number of physical files per each granule.
CPU (min)	Number of processing minutes required to produce a granule of this data.
MB per Day	Estimated amount of this data processed each data.
Record Size (bytes, 0=variable)	Size, in bytes, of a single record of data. 0 indicates a variable sized record.
Granule Size (MB)	Size, in megabytes, of a granule.
Granules per Day	Number of granules normally processed per day.
Revs per Granule	Number of earth revolutions contained in one granule.

6.4 Detailed Data Descriptions

Table 6-5 lists the fields shown in each data product format entry. The GLAS Standard Data

Table 6-5 GLAS Detailed Data Description Fields

Field	Description
Product Var Name	Unique identifying name of the product variable.
Offset (bytes)	Offset in bytes from start of data record (start=0).
Prod Data Type	Product (Unscaled) Variable Type and dimensions (in parens). i1b = Integer, 1 byte i2b = Integer, 2 bytes i4b = Integer, 4 bytes r4b = Real, 4 bytes r8b = Real, 8 bytes etc...
Total Bytes	Total number of bytes used by variable.
Is Unsigned?	Flag indicating if variable should be treated as unsigned.
Invalid Value/Flag	Indicates what identifies the filed as being invalid. None = variable cannot be invalid. gd_invalid_xxx = datatype-specific value which indicates the variable is not valid. [variable name] = name of the flag to check in order to determine validity of the variable.

Product Specification - Data Dictionary [Applicable Document 2.2.a] contains a comprehen-

sive data dictionary, set of flag definitions, and metadata definitions. Most of this information is also available on the WFF GLAS website at the following URL:

http://glas.wff.nasa.gov/prod_format/v60_products/index.html

Appendix A

Level 2 Data Products Description

A.1 Data Product Description

Table A-1 Data Product Description

Product ID	Name	Level	Science Discipline	Investigator	Archive Site	Source
GLA08	Boundary Layer height	2	Atmosphere	J. Spinhirne	NSIDC	ISIPS
GLA09	Cloud Height	2	Atmosphere	J. Spinhirne	Icesat SCF	ICESat SCF
GLA10	Aerosol Vertical Structure	2	Atmosphere	J. Spinhirne	Icesat SCF	Icesat SCF
GLA11	Thin Cloud/OD	2	Atmosphere	J. Spinhirne	Icesat SCF	ICESat SCF
GLA12	Ice Sheet Elevation	2	Elevations-Ice Sheet	Jay Zwally	Icesat SCF	ICESat SCF
GLA13	Sea Ice Roughness	2	Elevations-Sea Ice	Bob Thomas	Icesat SCF	ICESat SCF
GLA14	Land/Canopy Elevation	2	Elevations-Land	Jack Bufton	Icesat SCF	ICESat SCF
GLA15	Ocean Elevation	2	Elevations-Ocean	N/A	Icesat SCF	ICESat SCF

A.2 Data Coverage

Table A-2 Data Coverage

Product ID	Temporal Resolution (sec)	Temporal Coverage (min)	Horiz Res Coverage (m)	Vert Rez Coverage (m)	Root/ External Flag
GLA08	8	1380	-90 to 90	-180 to 180	0
GLA09	4	1380	170	76.8	0
GLA10	4	1380	170	76.8	0
GLA11	4	1380	170	76.8	0
GLA12	1	1380	170	0	0
GLA13	1	1380	170	0	0
GLA14	1	1380	170	0	0
GLA15	1	1380	170	0	0

A.3 Data Volume

Table A-3 Data Volume

Product ID	Freq.(per day)	Files per Gran.	CPU (min)	MB per Day	Record Size (0=variable)	Granule Size (MB)	Gran. per Day	Revs per Gran.
GLA08	1	1	80.07	16.31469727	792	16.31469727	1	14
GLA09	1	1	146.57	143.0419922	6944	143.0419922	1	14
GLA10	1	1	214.02	308.4960938	14976	308.4960938	1	14
GLA11	1	1	115.49	62.45727539	3032	62.45727539	1	14
GLA12	1	1	3.21	135.9558105	6600	135.9558105	1	14
GLA13	1	1	2.9	139.251709	6760	139.251709	1	14
GLA14	1	1	3.05	247.1923828	10000	247.1923828	1	14
GLA15	1	1	4.72	362.2192383	6280	362.2192383	1	14

Appendix B

Level 2 Data Product Formats

B.1 Record Formats

B.1.1 Guidelines

The GLAS Data Product record formats were developed under the following guidelines:

- 1) Record size a multiple of 4.
- 2) Start elements on a 4 byte boundary; where not possible use pads or group smaller elements together to get to 4 byte boundary. Pad and move elements so that arrays start on 4 byte boundaries.
- 3) The output structures to build files should be grouped in descending size order, therefore group elements on file logically and in descending size order.
- 4) Data that occurs occasionally in the file should be put in the header. Specifically, the orbit number and instrument state are changing at a much lower rate than the record rate on the files, therefore the orbit numbers and instrument states encompassed by a file will be put in the header. These elements will not be shown in the record format. Other data in the same category will be put in the header.
- 5) Add spares.

B.1.2 GLA08 - Boundary Layer Height

Each record contains 4 seconds of data. Empty aerosol or planetary boundary layers will contain fill data.

Table B-1 GLA08 Record Format

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned?	Invalid Value/ Flag
Record Type:GLA08_MAIN; % of Granule: 100; Record Duration (seconds):4; Repeats: 1						
Latest : Last Modified : Tue Sep 06 12:21:56 GMT-0400 (EDT) 2005						
i_rec_ndx	0	i4b	4	N/A	No	no
i_UTCTime	4	i4b (2)	8	seconds, microseconds	No	no
i_beam_coelev	12	i4b (4)	16	degrees*100	No	i4b
i_beam_azimuth	28	i4b (4)	16	degrees*100	No	i4b
i_pad_angle	44	i4b (4)	16	microdegrees	No	i4b
i_spare0	60	i1b (40)	40	null	NA	No
i_AttFlg1	100	i2b (4)	8	NA	No	no

Table B-1 GLA08 Record Format (Continued)

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned?	Invalid Value/ Flag
i_lat	108	i4b (4)	16	microdegrees	No	i4b
i_lon	124	i4b (4)	16	microdegrees	No	i4b
i_OrbFlg	140	i1b (2, 4)	8	NA	No	no
i_surfType	148	i1b (4)	4	NA	No	no
i_LidarQF	152	i2b (4)	8	NA	No	no
i_atm_dem	160	i4b (4)	16	meters	No	i4b
i4_aer_bot	176	i2b (5)	10	deka-meters	No	i4_aer_af
i4_aer_top	186	i2b (5)	10	deka-meters	No	i4_aer_af
i20_aer_bot	196	i2b (3)	6	deka-meters	No	i20_aer_af
i20_aer_top	202	i2b (3)	6	deka-meters	No	i20_aer_af
i_LRpbl_ht	208	i2b	2	deka-meters	No	i2b
i_LRpbl_grd	210	i2b	2	deka-meters	No	i2b
i_HRpbl_ht	212	i2b (20)	40	deka-meters	No	i2b
i_HRpbl_grd	252	i2b (20)	40	deka-meters	No	i2b
i4_aer_pct	292	i1b (5)	5	unitless	No	i4_aer_af
i20_aer_pct	297	i1b (3)	3	unitless	No	i20_aer_af
i_LRpbl_pct	300	i1b	1	unitless	No	i1b
i_LayHgt_Flag	301	i1b (32)	32	NA	No	no
i_AttFlg3	333	i1b	1	NA	No	No
i_timecorflg	334	i2b	2	N/A	No	No
i_Solar_Angle	336	i4b (4)	16	micro-degrees	No	i4b
i_Aer_top_b20_temp	352	i2b (5)	10	degrees Celsius * 100	No	i2b
i_Aer_top_b20_pres	362	i2b (5)	10	millibars of mercury * 10	No	i2b
i_Aer_top_b20_relh	372	i2b (5)	10	percentage * 100	No	i2b

Table B-1 GLA08 Record Format (Continued)

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned?	Invalid Value/Flag
i_Aer_bot_b20_temp	382	i2b (5)	10	degrees Celsius * 100	No	i2b
i_Aer_bot_b20_pres	392	i2b (5)	10	millibars of mercury * 10	No	i2b
i_Aer_bot_b20_relh	402	i2b (5)	10	percentage * 100	No	i2b
i_Aer_top_a20_temp	412	i2b (3)	6	degrees Celsius * 100	No	i2b
i_Aer_top_a20_pres	418	i2b (3)	6	millibars of mercury * 10	No	i2b
i_Aer_top_a20_relh	424	i2b (3)	6	percentage * 100	No	i2b
i_Aer_bot_a20_temp	430	i2b (3)	6	degrees Celsius * 100	No	i2b
i_Aer_bot_a20_pres	436	i2b (3)	6	millibars of mercury * 10	No	i2b
i_Aer_bot_a20_relh	442	i2b (3)	6	percentage * 100	No	i2b
i_Aer_PBL_LR_temp	448	i2b	2	degrees Celsius * 100	No	i2b
i_Aer_PBL_LR_pres	450	i2b	2	millibars of mercury * 10	No	i2b
i_Aer_PBL_LR_relh	452	i2b	2	percentage * 100	No	i2b
i_Aer_ir_top	454	i2b (2)	4	deka-meters	No	i2b
i_Aer_ir_bot	458	i2b (2)	4	deka-meters	No	i2b
i_Aer_ir_layflg	462	i1b (2)	2	N/A	No	No
i_Aer_ir_top_temp	464	i2b (2)	4	degrees Celsius * 100	No	i2b
i_Aer_ir_top_pres	468	i2b (2)	4	millibars of mercury * 10	No	i2b
i_Aer_ir_top_relh	472	i2b (2)	4	percentage * 100	No	i2b
i_Aer_ir_bot_temp	476	i2b (2)	4	degrees Celsius * 100	No	i2b
i_Aer_ir_bot_pres	480	i2b (2)	4	millibars of mercury * 10	No	i2b
i_Aer_ir_bot_relh	484	i2b (2)	4	percentage * 100	No	i2b

Table B-1 GLA08 Record Format (Continued)

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned?	Invalid Value/ Flag
i_Surface_temp	488	i2b (4)	8	degrees Celsius * 100	No	i2b
i_Surface_pres	496	i2b (4)	8	millibars of mercury * 10	No	i2b
i_Surface_relh	504	i2b (4)	8	percentage * 100	No	i2b
i_Surface_wind	512	i2b (4)	8	meters/second * 100	No	i2b
i_Surface_wdir	520	i2b (4)	8	degrees * 10	No	i2b
i_spare2	528	i1b (264)	264	NA	No	NA
Total Bytes	792					

B.1.3 GLA09 - Cloud Height

Each record contains 4 seconds of data. Empty cloud layers will contain fill data.

Table B-2 GLA09 Record Format

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned?	Invalid Value/ Flag
Record Type:GLA09_MAIN; % of Granule: 100; Record Duration (seconds):4; Repeats: 1						
Latest: Last Modified: Tue Sep 20 08:42:49 GMT-0400 (EDT) 2005						
i_rec_ndx	0	i4b	4	N/A	No	no
i_UTCTime	4	i4b (2)	8	seconds, microsec- onds	No	no
i_beam_coelev	12	i4b (4)	16	degrees*100	No	i4b
i_beam_azimuth	28	i4b (4)	16	degrees*100	No	i4b
i_pad_angle	44	i4b (4)	16	microdegrees	No	i4b
i_spare0	60	i1b (40)	40	null	NA	No
i_AttFlg1	100	i2b (4)	8	NA	No	no
i_lat	108	i4b (4)	16	microdegrees	No	i4b
i_lon	124	i4b (4)	16	microdegrees	No	i4b
i_OrbFlg	140	i1b (2, 4)	8	NA	No	no
i_surfType	148	i1b (4)	4	NA	No	no
i_LidarQF	152	i2b (4)	8	NA	No	no
i_spare2	160	i1b (8)	8	NA	No	NA
i_topo_elev	168	i4b (4)	16	meters	No	i4b
i_atm_dem	184	i4b (4)	16	meters	No	i4b
i_LRcld_bot	200	i2b (10)	20	deka-meters	No	i_LRC_ af
i_LRcld_top	220	i2b (10)	20	deka-meters	No	i_LRC_ af
i_LRcld_grd	240	i2b	2	deka-meters	No	i2b
i_spare3	242	i1b (2)	2	NA	No	NA
i_MRcld_bot	244	i2b (10, 4)	80	deka-meters	No	i_MRC_ af
i_MRcld_top	324	i2b (10, 4)	80	deka-meters	No	i_MRC_ af
i_MRcld_grd	404	i2b (4)	8	deka-meters	No	i2b

Table B-2 GLA09 Record Format (Continued)

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned?	Invalid Value/ Flag
i_MRcld_pct	412	i1b (10, 4)	40	unitless	No	i_MRC_af
i_HRcld_bot	452	i2b (10, 20)	400	deka-meters	No	i_HRC_af
i_HRcld_top	852	i2b (10, 20)	400	deka-meters	No	i_HRC_af
i_HRcld_grd	1252	i2b (20)	40	deka-meters	No	i2b
i_FRcld_bot	1292	i2b (160)	320	deka-meters	No	i_FRC_af
i_FRcld_top	1612	i2b (160)	320	deka-meters	No	i_FRC_af
i_FRcld_grd	1932	i2b (160)	320	deka-meters	No	i2b
i_FRg_grd_sig	2252	i4b (160)	640	e9/(m-sr)	No	i4b
i_FRir_grd_sig	2892	i4b (160)	640	e9/(m-sr)	No	i4b
i_LRCL_Flag	3532	i1b (11)	11	NA	No	no
i_MRCL_Flag	3543	i1b (37)	37	NA	No	no
i_HRCL_Flag	3580	i1b (185)	185	NA	No	no
i_FRCL_Flag	3765	i1b (220)	220	NA	No	no
i_AttFlg3	3985	i1b	1	NA	No	No
i_timecorflg	3986	i2b	2	N/A	No	No
i_FRir_cldtop	3988	i2b (160)	320	deka-meters	No	i2b
i_FRir_qaFlag	4308	i1b (160)	160	NA	No	No
i_FRir_intsig	4468	i2b (160)	320	e7/(m-sr)	No	i2b
i_Solar_Angle	4788	i4b (4)	16	micro-degrees	No	i4b
i_LRir_cld_top	4804	i2b (10)	20	deka-meters	No	i2b
i_LRir_cld_bot	4824	i2b (10)	20	deka-meters	No	i2b
i_LRir_QAflag	4844	i1b (10)	10	NA	No	No
i_LRir_cldtop_temp	4854	i2b (10)	20	degrees Celsius * 100	No	i2b
i_LRir_cldtop_pres	4874	i2b (10)	20	millibars of mercury * 10	No	i2b
i_LRir_cldtop_relh	4894	i2b (10)	20	percentage * 100	No	i2b

Table B-2 GLA09 Record Format (Continued)

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned?	Invalid Value/Flag
i_LRir_cldbot_temp	4914	i2b (10)	20	degrees Celsius * 100	No	i2b
i_LRir_cldbot_pres	4934	i2b (10)	20	millibars of mercury * 10	No	i2b
i_LRir_cldbot_relh	4954	i2b (10)	20	percentage * 100	No	i2b
i_MRir_cld_top	4974	i2b (10, 4)	80	deka-meters	No	i2b
i_MRir_cld_bot	5054	i2b (10, 4)	80	deka-meters	No	i2b
i_MRir_QAflag	5134	i1b (40)	40	NA	No	No
i_MRir_cldtop_temp	5174	i2b (10, 4)	80	degrees Celsius * 100	No	i2b
i_MRir_cldtop_pres	5254	i2b (10, 4)	80	millibars of mercury * 10	No	i2b
i_MRir_cldtop_relh	5334	i2b (10, 4)	80	percentage * 100	No	i2b
i_MRir_cldbot_temp	5414	i2b (10, 4)	80	degrees Celsius * 100	No	i2b
i_MRir_cldbot_pres	5494	i2b (10, 4)	80	millibars of mercury * 10	No	i2b
i_MRir_cldbot_relh	5574	i2b (10, 4)	80	percentage * 100	No	i2b
i_LRg_cldtop_temp	5654	i2b (10)	20	degrees Celsius * 100	No	i2b
i_LRg_cldtop_pres	5674	i2b (10)	20	millibars of mercury * 10	No	i2b
i_LRg_cldtop_relh	5694	i2b (10)	20	percentage * 100	No	i2b
i_LRg_cldbot_temp	5714	i2b (10)	20	degrees Celsius * 100	No	i2b
i_LRg_cldbot_pres	5734	i2b (10)	20	millibars of mercury * 10	No	i2b
i_LRg_cldbot_relh	5754	i2b (10)	20	percentage * 100	No	i2b
i_MRg_cldtop_temp	5774	i2b (10, 4)	80	degrees Celsius * 100	No	i2b

Table B-2 GLA09 Record Format (Continued)

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned?	Invalid Value/ Flag
i_MRg_cldtop_pres	5854	i2b (10, 4)	80	millibars of mercury * 10	No	i2b
i_MRg_cldtop_relh	5934	i2b (10, 4)	80	percentage * 100	No	i2b
i_MRg_cldbot_temp	6014	i2b (10, 4)	80	degrees Celsius * 100	No	i2b
i_MRg_cldbot_pres	6094	i2b (10, 4)	80	millibars of mercury * 10	No	i2b
i_MRg_cldbot_relh	6174	i2b (10, 4)	80	percentage * 100	No	i2b
i_LRg_SourceFt	6254	i2b	2	Unknown	No	i2b
i_MRg_SourceFt	6256	i2b (4)	8	Unknown	No	i2b
i_HRg_SourceFt	6264	i2b (20)	40	Unknown	No	i2b
i_LRir_SourceFt	6304	i2b	2	Unknown	No	i2b
i_MRir_SourceFt	6306	i2b (4)	8	Unknown	No	i2b
i_Surface_temp	6314	i2b (4)	8	degrees Celsius * 100	No	i2b
i_Surface_pres	6322	i2b (4)	8	millibars of mercury * 10	No	i2b
i_Surface_relh	6330	i2b (4)	8	percentage * 100	No	i2b
i_Surface_wind	6338	i2b (4)	8	meters/second * 100	No	i2b
i_Surface_wdir	6346	i2b (4)	8	degrees * 10	No	i2b
i_spare4	6354	i1b (590)	590	NA	No	NA
Total Bytes	6944					

B.1.4 GLA10 - Aerosol Vertical Structure

Each record contains 4 seconds of data.

Table B-3 GLA10 Record Format

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned?	Invalid Value/ Flag
Record Type:GLA10_MAIN; % of Granule: 100; Record Duration (seconds):4; Repeats: 1						
Latest : Last Modified : Tue Sep 06 12:20:48 GMT-0400 (EDT) 2005						
i_rec_ndx	0	i4b	4	N/A	No	no
i_UTCTime	4	i4b (2)	8	seconds, microsec- onds	No	no
i_beam_coelev	12	i4b (4)	16	degrees*100	No	i4b
i_beam_azimuth	28	i4b (4)	16	degrees*100	No	i4b
i_pad_angle	44	i4b (4)	16	microdegrees	No	i4b
i_spare0	60	i1b (40)	40	null	NA	No
i_AttFlg1	100	i2b (4)	8	NA	No	no
i_lat	108	i4b (4)	16	microdegrees	No	i4b
i_lon	124	i4b (4)	16	microdegrees	No	i4b
i_OrbFlg	140	i1b (2, 4)	8	NA	No	no
i_surfType	148	i1b (4)	4	NA	No	no
i_LidarQF	152	i2b (4)	8	NA	No	no
i_cld1_bs_prof	160	i4b (280, 4)	4480	e10/(m-sr)	No	i4b
i_cld1_ext_prof	4640	i4b (280, 4)	4480	e9/m	No	i4b
i_aer4_bs_prof	9120	i4b (548)	2192	e10/(m-sr)	No	i4b
i_aer4_ext_prof	11312	i4b (548)	2192	e9/m	No	i4b
i_cld1_sval1	13504	i2b (10, 4)	80	100*sr	No	i2b
i_cld1_sval2	13584	i2b (10, 4)	80	100*sr	No	i2b
i_aer4_sval1	13664	i2b (9)	18	100*sr	No	i2b
i_aer4_sval2	13682	i2b (9)	18	100*sr	No	i2b
i_cld1_bot	13700	i2b (10, 4)	80	deka-meters	No	i2b

Table B-3 GLA10 Record Format (Continued)

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned?	Invalid Value/ Flag
i_cld1_top	13780	i2b (10, 4)	80	deka-meters	No	i2b
i_cld1_grd_det	13860	i2b (4)	8	deka-meters	No	i2b
i_aer4_bot	13868	i2b (9)	18	deka-meters	No	i2b
i_aer4_top	13886	i2b (9)	18	deka-meters	No	i2b
i_pbl4_grd_det	13904	i2b	2	deka-meters	No	i2b
i_spare2	13906	i1b (2)	2	NA	No	NA
i_cld1_sval_uf	13908	i1b (20)	20	NA	No	no
i_aer4_sval_uf	13928	i1b (5)	5	NA	No	no
i_spare3	13933	i1b (3)	3	NA	No	NA
i_cld1_bs_flag	13936	i1b (40)	40	NA	No	no
i_cld1_ext_flag	13976	i1b (40)	40	NA	No	no
i_aer4_bs_flag	14016	i1b (10)	10	NA	No	no
i_aer4_ext_flag	14026	i1b (10)	10	NA	No	no
i_spare4	14036	i1b	1	null	NA	No
i_AttFlg3	14037	i1b	1	NA	No	No
i_timecorflg	14038	i2b	2	N/A	No	No
i_Solar_Angle	14040	i4b (4)	16	micro-degrees	No	i4b
i_MRg_cldtop_temp	14056	i2b (10, 4)	80	degrees Celsius * 100	No	i2b
i_MRg_cldtop_pres	14136	i2b (10, 4)	80	millibars of mercury * 10	No	i2b
i_MRg_cldtop_relh	14216	i2b (10, 4)	80	percentage * 100	No	i2b
i_MRg_cldbot_temp	14296	i2b (10, 4)	80	degrees Celsius * 100	No	i2b
i_MRg_cldbot_pres	14376	i2b (10, 4)	80	millibars of mercury * 10	No	i2b
i_MRg_cldbot_relh	14456	i2b (10, 4)	80	percentage * 100	No	i2b
i_Aer_top_temp	14536	i2b (9)	18	degrees Celsius * 100	No	i2b

Table B-3 GLA10 Record Format (Continued)

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned?	Invalid Value/ Flag
i_Aer_top_pres	14554	i2b (9)	18	millibars of mercury * 10	No	i2b
i_Aer_top_relh	14572	i2b (9)	18	percentage * 100	No	i2b
i_Aer_bot_temp	14590	i2b (9)	18	degrees Celsius * 100	No	i2b
i_Aer_bot_pres	14608	i2b (9)	18	millibars of mercury * 10	No	i2b
i_Aer_bot_relh	14626	i2b (9)	18	percentage * 100	No	i2b
i_Surface_temp	14644	i2b (4)	8	degrees Celsius * 100	No	i2b
i_Surface_pres	14652	i2b (4)	8	millibars of mercury * 10	No	i2b
i_Surface_relh	14660	i2b (4)	8	percentage * 100	No	i2b
i_Surface_wind	14668	i2b (4)	8	meters/second * 100	No	i2b
i_Surface_wdir	14676	i2b (4)	8	degrees * 10	No	i2b
i_spare5	14684	i1b (292)	292	NA	No	NA
Total Bytes	14976					

B.1.5 GLA11 - Thin Cloud/OD

Each record contains 4 seconds of data.

Table B-4 GLA11 Record Format

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned ?	Invalid Value/ Flag
Record Type:GLA11_MAIN; % of Granule: 100; Record Duration (seconds):4; Repeats: 1						
Latest : Last Modified : Tue Sep 20 08:42:49 GMT-0400 (EDT) 2005						
i_rec_ndx	0	i4b	4	N/A	No	no
i_UTCTime	4	i4b (2)	8	seconds, microsec- onds	No	no
i_beam_coelev	12	i4b (4)	16	degrees*100	No	i4b
i_beam_azimuth	28	i4b (4)	16	degrees*100	No	i4b
i_pad_angle	44	i4b (4)	16	microdegrees	No	i4b
i_spare0	60	i1b (40)	40	null	NA	No
i_AttFlg1	100	i2b (4)	8	NA	No	no
i_lat	108	i4b (4)	16	microdegrees	No	i4b
i_lon	124	i4b (4)	16	microdegrees	No	i4b
i_OrbFlg	140	i1b (2, 4)	8	NA	No	no
i_surfType	148	i1b (4)	4	NA	No	no
i_LidarQF	152	i2b (4)	8	NA	No	no
i_cld1_od	160	i2b (10, 4)	80	unitless*1000	No	i2b
i_aer4_od	240	i2b (8)	16	unitless*1000	No	i2b
i_pbl4_od	256	i2b	2	unitless*1000	No	i2b
i_aer4_msf	258	i2b (9)	18	unitless	No	i2b
i_cld1_msf	276	i2b (10, 4)	80	unitless	No	i2b
i_cld1_bot	356	i2b (10, 4)	80	deka-meters	No	i2b
i_cld1_top	436	i2b (10, 4)	80	deka-meters	No	i2b
i_cld1_grd_det	516	i2b (4)	8	deka-meters	No	i2b
i_aer4_bot	524	i2b (8)	16	deka-meters	No	i2b
i_aer4_top	540	i2b (8)	16	deka-meters	No	i2b

Table B-4 GLA11 Record Format (Continued)

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned ?	Invalid Value/ Flag
i_aer4_ht	556	i2b	2	deka-meters	No	i2b
i_aer4_grd_det	558	i2b	2	deka-meters	No	i2b
i_erd	560	i2b (4)	8	millimeters	No	i2b
i_pse	568	i2b (4)	8	microns	No	i2b
i_cld1_mswf	576	i1b (2)	2	NA	No	no
i_cld1_flag	578	i1b (40)	40	NA	No	no
i_aer4_flag	618	i1b (8)	8	NA	No	no
i_pbl4_flag	626	i1b	1	NA	No	no
i_AttFlg3	627	i1b	1	NA	No	No
i_timecorflg	628	i2b	2	N/A	No	No
i_rdu	630	i2b (4)	8	millimeters	No	i2b
i_spare2	638	i1b (2)	2	NA	No	NA
i_Solar_Angle	640	i4b (4)	16	micro-degrees	No	i4b
i_MRg_cldtop_temp	656	i2b (10, 4)	80	degrees Celsius * 100	No	i2b
i_MRg_cldtop_pres	736	i2b (10, 4)	80	millibars of mercury * 10	No	i2b
i_MRg_cldtop_relh	816	i2b (10, 4)	80	percentage * 100	No	i2b
i_MRg_cldbot_temp	896	i2b (10, 4)	80	degrees Celsius * 100	No	i2b
i_MRg_cldbot_pres	976	i2b (10, 4)	80	millibars of mercury * 10	No	i2b
i_MRg_cldbot_relh	1056	i2b (10, 4)	80	percentage * 100	No	i2b
i_Aer_top_temp	1136	i2b (9)	18	degrees Celsius * 100	No	i2b
i_Aer_top_pres	1154	i2b (9)	18	millibars of mercury * 10	No	i2b
i_Aer_top_relh	1172	i2b (9)	18	percentage * 100	No	i2b
i_Aer_bot_temp	1190	i2b (9)	18	degrees Celsius * 100	No	i2b

Table B-4 GLA11 Record Format (Continued)

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned ?	Invalid Value/ Flag
i_Aer_bot_pres	1208	i2b (9)	18	millibars of mercury * 10	No	i2b
i_Aer_bot_relh	1226	i2b (9)	18	percentage * 100	No	i2b
i_Aer_ir_top	1244	i2b (2)	4	deka-meters	No	i2b
i_Aer_ir_bot	1248	i2b (2)	4	deka-meters	No	i2b
i_Aer_ir_top_temp	1252	i2b (2)	4	degrees Celsius * 100	No	i2b
i_Aer_ir_top_pres	1256	i2b (2)	4	millibars of mercury * 10	No	i2b
i_Aer_ir_top_relh	1260	i2b (2)	4	percentage * 100	No	i2b
i_Aer_ir_bot_temp	1264	i2b (2)	4	degrees Celsius * 100	No	i2b
i_Aer_ir_bot_pres	1268	i2b (2)	4	millibars of mercury * 10	No	i2b
i_Aer_ir_bot_relh	1272	i2b (2)	4	percentage * 100	No	i2b
i_MRir_cld_top	1276	i2b (10, 4)	80	deka-meters	No	i2b
i_MRir_cld_bot	1356	i2b (10, 4)	80	deka-meters	No	i2b
i_MRir_cldtop_temp	1436	i2b (10, 4)	80	degrees Celsius * 100	No	i2b
i_MRir_cldtop_pres	1516	i2b (10, 4)	80	millibars of mercury * 10	No	i2b
i_MRir_cldtop_relh	1596	i2b (10, 4)	80	percentage * 100	No	i2b
i_MRir_cldbot_temp	1676	i2b (10, 4)	80	degrees Celsius * 100	No	i2b
i_MRir_cldbot_pres	1756	i2b (10, 4)	80	millibars of mercury * 10	No	i2b
i_MRir_cldbot_relh	1836	i2b (10, 4)	80	percentage * 100	No	i2b
i_MRir_QAflag	1916	i1b (40)	40	NA	No	No
i_Aer_PBL_LR_temp	1956	i2b	2	degrees Celsius * 100	No	i2b

Table B-4 GLA11 Record Format (Continued)

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned ?	Invalid Value/ Flag
i_Aer_PBL_LR_pres	1958	i2b	2	millibars of mercury * 10	No	i2b
i_Aer_PBL_LR_relh	1960	i2b	2	percentage * 100	No	i2b
i_Surface_temp	1962	i2b (4)	8	degrees Celsius * 100	No	i2b
i_Surface_pres	1970	i2b (4)	8	millibars of mercury * 10	No	i2b
i_Surface_relh	1978	i2b (4)	8	percentage * 100	No	i2b
i_Surface_wind	1986	i2b (4)	8	meters/second * 100	No	i2b
i_Surface_wdir	1994	i2b (4)	8	degrees * 10	No	i2b
i_Aer_ir_OD	2002	i2b (2)	4	Unknown	No	i2b
i_cld_ir_OD	2006	i2b (10, 4)	80	Unknown	No	i2b
i_Aer_ir_ODFlg	2086	i1b (2)	2	N/A	No	No
i_cld_ir_ODFlg	2088	i1b (10, 4)	40	N/A	No	No
i_FRir_ODflg	2128	i1b (160)	160	NA	No	No
i_FRir_qaFlag	2288	i1b (160)	160	NA	No	No
i_FRir_cldtop	2448	i2b (160)	320	deka-meters	No	i2b
i_Aer_b20_prop	2768	i1b (20, 5)	100	Unknown	No	i1b
i_PBL_prop	2868	i1b (20)	20	Unknown	No	i1b
i_spare3	2888	i1b (144)	144	N/A	No	No
Total Bytes	3032					

B.1.6 GLA12 - Ice Sheet Elevation

Each record contains 1 second of data.

Table B-5 GLA12 Record Format

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned?	Invalid Value/ Flag
Record Type:GLA12_MAIN; % of Granule: 25; Record Duration (seconds):1; Repeats: 1						
Latest : Last Modified : Mon Sep 19 09:22:56 GMT-0400 (EDT) 2005						
i_rec_ndx	0	i4b	4	N/A	0	no
i_UTCTime	4	i4b (2)	8	seconds, micro-seconds	0	no
i_transtime	12	i2b	2	microseconds	0	i2b
i_Spare1	14	i1b (2)	2	N/A	null	No
i_deltagpstmcor	16	i4b	4	nanoseconds	0	gi_inval id_i4b
i_dShotTime	20	i4b (39)	156	microseconds	0	No
i_lat	176	i4b (40)	160	microdeg	-90000000	i4b
i_lon	336	i4b (40)	160	microdeg	0	i4b
i_elev	496	i4b (40)	160	mm	-500000	i4b
i_PADPoint	656	i4b (6, 40)	960	Unitless*1000000	-1000000	i4b
i_PODFixedPos	1616	i4b (6, 40)	960	3 * (m, mm)	-7.00E+10	i4b
i_sigmaatt	2576	i2b (40)	80	Unitless	0	i2b
i_Azimuth	2656	i4b	4	millideg	0	i4b
i_SolAng	2660	i4b	4	microdeg	-90000000	i4b
i_tpintensity_avg	2664	i4b	4	counts	0	i4b
i_tpazimuth_avg	2668	i2b	2	degrees*10	0	i2b
i_tpeccentricity_avg	2670	i2b	2	Unitless*1000	0	i2b
i_tpmajoraxis_avg	2672	i2b	2	cm	0	i2b
i_Spare2	2674	i1b (2)	2	null	null	null
i_gdHt	2676	i2b (2)	4	cm	-20000	i2b
i_erElv	2680	i2b (2)	4	mm	-10000	i2b
i_spElv	2684	i2b (4)	8	mm	-10000	i2b
i_ldElv	2692	i2b (4)	8	mm	-10000	i2b

Table B-5 GLA12 Record Format (Continued)

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned?	Invalid Value/ Flag
i_ocElv	2700	i2b (2)	4	mm	-10000	i2b
i_wTrop	2704	i2b (2)	4	mm	-1000	i2b
i_dTrop	2708	i2b (40)	80	mm	-2500	i2b
i_surfType	2788	i1b	1	N/A	1	No
i_Spare3	2789	i1b (3)	3	N/A	null	null
i_DEM_elv	2792	i4b (40)	160	cm	-50000	i4b
i_refRng	2952	i4b (40)	160	mm	400000000	i4b
i_TrshRngOff	3112	i4b (40)	160	mm	-150000	i4b
i_isRngOff	3272	i4b (40)	160	mm	-150000	i4b
i_SigEndOff	3432	i4b (40)	160	mm	-150000	i4b
i_cntRngOff	3592	i4b (40)	160	mm	-150000	i4b
i_reflctUncorr	3752	i4b (40)	160	Unitless*1E06	0	i4b
i_reflCor_atm	3912	i4b	4	Unitless*1E06	0	i4b
i_maxSmAmp	3916	i2b (40)	80	Tenth of millivolts	-300	No
i_SigmaElv	3996	i2b (40)	80	mm	0	i2b
i_numPk	4076	i1b (40)	40	N/A	0	No
i_kurt2	4116	i2b (40)	80	unitless * 100	-1000	i2b
i_skew2	4196	i2b (40)	80	unitless * 100	-10000	i2b
i_IceSheetRuf	4276	i2b (40)	80	cm	0	i2b
i_IsSlopeEmp	4356	i2b (40)	80	millideg	0	i2b
i_IsRngLast	4436	i4b (40)	160	mm	-150000	i4b
i_IsRngFst	4596	i4b (40)	160	mm	-150000	i4b
i_IceSVar	4756	i2b (40)	80	millivolts	0	i2b
i_ElvuseFlg	4836	i1b (5)	5	N/A	-127	No
i_atm_avail	4841	i1b	1	NA	0	No
i_erd	4842	i2b	2	Millimeters	0	i2b
i_rdu	4844	i2b	2	Millimeters	0	i2b
i_cld1_mswf	4846	i1b	1	NA	0	No
i_MRC_af	4847	i1b	1	NA	0	No

Table B-5 GLA12 Record Format (Continued)

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned?	Invalid Value/ Flag
i_SurfRuf_slpQF	4848	i1b (40)	40	N/A	0	No
i_ElvFlg	4888	i1b (40)	40	N/A	0	No
i_rng_UQF	4928	i2b (40)	80	N/A	0	No
i_atmQF	5008	i1b (10)	10	N/A	0	No
i_timecorflg	5018	i2b	2	N/A	0	No
i_APID_AvFlg	5020	i1b (8)	8	n/a	-127	No
i_AttFlg2	5028	i1b (20)	20	NA	0	no
i_spare5	5048	i1b	1	NA	0	NA
i_FrameQF	5049	i1b	1	N/A	0	No
i_OrbFlg	5050	i1b (2)	2	NA	0	no
i_rngCorrFlg	5052	i1b (2)	2	N/A	0	No
i_CorrStatFlg	5054	i1b (2)	2	NA	0	no
i_beam_coelev	5056	i4b	4	degrees*100	0	i4b
i_beam_azimuth	5060	i4b	4	degrees*100	0	i4b
i_AttFlg1	5064	i2b	2	N/A	0	No
i_Spare6	5066	i1b (2)	2	N/A	null	null
i_DEM_hires_src	5068	i1b (40)	40	NA	0	No
i_DEM_hires_elv	5108	i2b (40)	80	meters	-500	i2b
i_satNdx	5188	i1b (40)	40	ns	0	i1b
i_satRngCorr	5228	i2b (40)	80	mm	0	i2b
i_satCorrFlg	5308	i1b (40)	40	NA	NA	No
i_satNrgCorr	5348	i2b (40)	80	mm	0	i2b
i_satPwdCorr	5428	i2b (40)	80	mm	0	i2b
i_gval_rcv	5508	i2b (40)	80	counts	0	i2b
i_RecNrgAll	5588	i2b (40)	80	0.01 fJoules	0	i_APID_AvFlg
i_FRir_cldtop	5668	i2b (40)	80	deka-meters	0	i2b
i_FRir_qaFlag	5748	i1b (40)	40	NA	0	No
i_FRir_ODflg	5788	i1b (40)	40	NA	0	No

Table B-5 GLA12 Record Format (Continued)

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned?	Invalid Value/ Flag
i_FRir_intsig	5828	i2b (40)	80	e7/(m-sr)	0	i2b
i_msRngCorr	5908	i2b (40)	80	Unknown	0	i2b
i_msCorrFlg	5988	i1b (40)	40	Unknown	0	No
i_Surface_temp	6028	i2b	2	degrees Celsius * 100	-10000	i2b
i_Surface_pres	6030	i2b	2	millibars of mercury * 10	0	i2b
i_Surface_relh	6032	i2b	2	percentage * 100	0	i2b
i_spare7	6034	i1b (566)	566	NA	null	null
Total Bytes	6600					

B.1.7 GLA13 - Sea Ice Roughness

Each record contains 1 second of data.

Table B-6 GLA13 Record Format

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned?	Invalid Value/Flag
Record Type:GLA13_MAIN; % of Granule: 25; Record Duration (seconds):1; Repeats: 1						
Latest : Last Modified : Mon Sep 19 09:22:56 GMT-0400 (EDT) 2005						
i_rec_ndx	0	i4b	4	N/A	0	no
i_UTCTime	4	i4b (2)	8	seconds, microseconds	0	no
i_transtime	12	i2b	2	microseconds	0	i2b
i_Spare1	14	i1b (2)	2	N/A	null	No
i_deltagpstmcor	16	i4b	4	nanoseconds	0	gi_invalid_i4b
i_dShotTime	20	i4b (39)	156	microseconds	0	No
i_lat	176	i4b (40)	160	microdeg	-90000000	i4b
i_lon	336	i4b (40)	160	microdeg	0	i4b
i_elev	496	i4b (40)	160	mm	-500000	i4b
i_PADPoint	656	i4b (6, 40)	960	Unitless*1000000	-1000000	i4b
i_PODFixedPos	1616	i4b (6, 40)	960	3 * (m, mm)	-7.00E+10	i4b
i_sigmaatt	2576	i2b (40)	80	Unitless	0	i2b
i_Azimuth	2656	i4b	4	millideg	0	i4b
i_SolAng	2660	i4b	4	microdeg	-90000000	i4b
i_tpintensity_avg	2664	i4b	4	counts	0	i4b
i_tpazimuth_avg	2668	i2b	2	degrees*10	0	i2b
i_tpeccentricity_avg	2670	i2b	2	Unitless*1000	0	i2b
i_tpmajoraxis_avg	2672	i2b	2	cm	0	i2b
i_Spare2	2674	i1b (2)	2	N/A	null	No
i_gdHt	2676	i2b 2)	4	cm	-20000	i2b
i_erElv	2680	i2b 2)	4	mm	-10000	i2b

Table B-6 GLA13 Record Format (Continued)

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned?	Invalid Value/Flag
i_spElv	2684	i2b (4)	8	mm	-10000	i2b
i_ldElv	2692	i2b (4)	8	mm	-10000	i2b
i_ocElv	2700	i2b (2)	4	mm	-10000	i2b
i_wTrop	2704	i2b (2)	4	mm	-1000	i2b
i_dTrop	2708	i2b (40)	80	mm	-2500	i2b
i_surfType	2788	i1b	1	N/A	1	No
i_Spare3	2789	i1b (3)	3	N/A	null	No
i_DEM_elv	2792	i4b (40)	160	cm	-50000	i4b
i_refRng	2952	i4b (40)	160	mm	400000000	i4b
i_TrshRngOff	3112	i4b (40)	160	mm	-150000	i4b
i_siRngOff	3272	i4b (40)	160	mm	-150000	i4b
i_SigEndOff	3432	i4b (40)	160	mm	-150000	i4b
i_cntRngOff	3592	i4b (40)	160	mm	-150000	i4b
i_reflctUncorr	3752	i4b (40)	160	Unitless*1E06	0	i4b
i_reflCor_atm	3912	i4b	4	Unitless*1E06	0	i4b
i_maxSmAm p	3916	i2b (40)	80	Tenth of millivolts	-300	No
i_SigmaElv	3996	i2b (40)	80	mm	0	i2b
i_numPk	4076	i1b (40)	40	N/A	0	No
i_RufSealce	4116	i2b (40)	80	cm	0	i2b
i_skew2	4196	i2b (40)	80	unitless * 100	-10000	i2b
i_SiRufLstPk	4276	i2b (40)	80	cm	0	i2b
i_AvgRuf	4356	i2b (40)	80	cm	0	i4b
i_BergElev	4436	i4b (40)	160	mm	0	i4b
i_Spare7	4596	i2b (40)	80	N/A	null	No
i_SiRufMaxP k	4676	i2b (40)	80	cm	0	i2b
i_SiRngFst	4756	i4b (40)	160	mm	-150000	i4b
i_SealceVar	4916	i2b (40)	80	millivolts	0	i2b
i_ElvuseFlg	4996	i1b (5)	5	N/A	-127	No

Table B-6 GLA13 Record Format (Continued)

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned?	Invalid Value/Flag
i_atm_avail	5001	i1b	1	NA	0	No
i_erd	5002	i2b	2	Millimeters	0	i2b
i_rdu	5004	i2b	2	Millimeters	0	i2b
i_cld1_mswf	5006	i1b	1	NA	0	No
i_MRC_af	5007	i1b	1	NA	0	No
i_SiRufQF	5008	i1b (40)	40	N/A	0	No
i_ElvFlg	5048	i1b (40)	40	N/A	0	No
i_rng_UQF	5088	i2b (40)	80	N/A	0	No
i_atmQF	5168	i1b (10)	10	N/A	0	No
i_timecorflg	5178	i2b	2	N/A	0	No
i_APID_AvFlg	5180	i1b (8)	8	n/a	-127	No
i_AttFlg2	5188	i1b (20)	20	NA	0	no
i_spare5	5208	i1b	1	NA	0	NA
i_FrameQF	5209	i1b	1	N/A	0	No
i_OrbFlg	5210	i1b (2)	2	NA	0	no
i_rngCorrFlg	5212	i1b (2)	2	N/A	0	No
i_CorrStatFlg	5214	i1b (2)	2	NA	0	no
i_beam_colevation	5216	i4b	4	degrees*100	0	i4b
i_beam_azimuth	5220	i4b	4	degrees*100	0	i4b
i_AttFlg1	5224	i2b	2	N/A	0	No
i_Spare6	5226	i1b (2)	2	N/A	null	No
i_DEM_hires_src	5228	i1b (40)	40	NA	0	No
i_DEM_hires_elv	5268	i2b (40)	80	meters	-500	i2b
i_satNdx	5348	i1b (40)	40	ns	0	i1b
i_satRngCorr	5388	i2b (40)	80	mm	0	i2b
i_satCorrFlg	5468	i1b (40)	40	NA	NA	No

Table B-6 GLA13 Record Format (Continued)

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned?	Invalid Value/Flag
i_satNrgCorr	5508	i2b (40)	80	mm	0	i2b
i_satPwdCorr	5588	i2b (40)	80	mm	0	i2b
i_gval_rcv	5668	i2b (40)	80	counts	0	i2b
i_RecNrgAll	5748	i2b (40)	80	0.01 fJoules	0	i_APID_AvFlag
i_FRir_cldtop	5828	i2b (40)	80	deka-meters	0	i2b
i_FRir_qaFlag	5908	i1b (40)	40	NA	0	No
i_FRir_ODflg	5948	i1b (40)	40	NA	0	No
i_FRir_intsig	5988	i2b (40)	80	e7/(m-sr)	0	i2b
i_msRngCorr	6068	i2b (40)	80	Unknown	0	i2b
i_msCorrFlg	6148	i1b (40)	40	Unknown	0	No
i_Surface_temp	6188	i2b	2	degrees Celsius * 100	-10000	i2b
i_Surface_press	6190	i2b	2	millibars of mercury * 10	0	i2b
i_Surface_relh	6192	i2b	2	percentage * 100	0	i2b
i_spare8	6194	i1b (566)	566	N/A	null	No
Total Bytes	6760					

B.1.8 GLA14 - Land/Canopy Elevation

Each record contains 1 second of data.

Table B-7 GLA14 Record Format

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned?	Invalid Value/Flag
Record Type:GLA14_MAIN; % of Granule: 30; Record Duration (seconds):1; Repeats: 1						
Latest : Last Modified : Mon Sep 19 09:22:56 GMT-0400 (EDT) 2005						
i_rec_ndx	0	i4b	4	N/A	0	no
i_UTCTime	4	i4b (2)	8	seconds, micro-seconds	0	no
i_transtime	12	i2b	2	microseconds	0	i2b
i_Spare1	14	i1b (2)	2	N/A	null	No
i_deltagpstmc or	16	i4b	4	nanoseconds	0	gi_invalid_i4 b
i_dShotTime	20	i4b (39)	156	microseconds	0	No
i_lat	176	i4b (40)	160	microdeg	-90000000	i4b
i_lon	336	i4b (40)	160	microdeg	0	i4b
i_elev	496	i4b (40)	160	mm	-500000	i4b
i_PADPoint	656	i4b (6, 40)	960	Unitless*1000000	-1000000	i4b
i_PODFixedP os	1616	i4b (6, 40)	960	3 * (m, mm)	-7.00E+10	i4b
i_sigmaatt	2576	i2b (40)	80	Unitless	0	i2b
i_Azimuth	2656	i4b	4	millideg	0	i4b
i_SolAng	2660	i4b	4	microdeg	-90000000	i4b
i_tpintensity_ avg	2664	i4b	4	counts	0	i4b
i_tpazimuth_ avg	2668	i2b	2	degrees*10	0	i2b
i_tpeccentricit y_avg	2670	i2b	2	Unitless*1000	0	i2b
i_tpmajoraxis_ avg	2672	i2b	2	cm	0	i2b
i_Spare2	2674	i1b (2)	2	N/A	null	No
i_gdHt	2676	i2b (2)	4	cm	-20000	i2b

Table B-7 GLA14 Record Format (Continued)

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned?	Invalid Value/Flag
i_erElv	2680	i2b (2)	4	mm	-10000	i2b
i_spElv	2684	i2b (4)	8	mm	-10000	i2b
i_ldElv	2692	i2b (4)	8	mm	-10000	i2b
i_ocElv	2700	i2b (2)	4	mm	-10000	i2b
i_wTrop	2704	i2b (2)	4	mm	-1000	i2b
i_dTrop	2708	i2b (40)	80	mm	-2500	i2b
i_surfType	2788	i1b	1	N/A	1	No
i_Spare3	2789	i1b (3)	3	N/A	null	No
i_DEM_elv	2792	i4b (40)	160	cm	-50000	i4b
i_refRng	2952	i4b (40)	160	mm	400000000	i4b
i_SigBegOff	3112	i4b (40)	160	mm	-150000	i4b
i_ldRngOff	3272	i4b (40)	160	mm	-150000	i4b
i_SigEndOff	3432	i4b (40)	160	mm	-150000	i4b
i_gpCntRngOff	3592	i4b (6, 40)	960	mm	-150000	i4b
i_reflctUncorr	4552	i4b (40)	160	Unitless*1E06	0	i4b
i_reflCor_atm	4712	i4b	4	Unitless*1E06	0	i4b
i_maxSmAmp	4716	i2b (40)	80	Tenth of millivolts	-300	No
i_SigmaElv	4796	i2b (40)	80	mm	0	i2b
i_numPk	4876	i1b (40)	40	N/A	0	No
i_kurt1	4916	i2b (40)	80	unitless * 100	-1000	i2b
i_skew1	4996	i2b (40)	80	unitless * 100	-10000	i2b
i_LdRufLstPk	5076	i2b (40)	80	cm	0	i2b
i_LandSlopeLast	5156	i2b (40)	80	millideg	0	i2b
i_Gamp	5236	i4b (6, 40)	960	0.01 volts	0	i4b
i_Garea	6196	i4b (6, 40)	960	0.01 volts * ns	0	i4b
i_Gsigma	7156	i4b (6, 40)	960	0.001 ns	0	i4b
i_nPeaks1	8116	i1b (40)	40	NA	0	no

Table B-7 GLA14 Record Format (Continued)

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned?	Invalid Value/Flag
i_LandVar	8156	i2b (40)	80	millivolts	0	i2b
i_ElvuseFlg	8236	i1b (5)	5	N/A	-127	No
i_atm_avail	8241	i1b	1	NA	0	No
i_erd	8242	i2b	2	Millimeters	0	i2b
i_rdu	8244	i2b	2	Millimeters	0	i2b
i_cld1_mswf	8246	i1b	1	NA	0	No
i_MRC_af	8247	i1b	1	NA	0	No
i_SurfRuf_slp QF	8248	i1b (40)	40	N/A	0	No
i_ElvFlg	8288	i1b (40)	40	N/A	0	No
i_rng_UQF	8328	i2b (40)	80	N/A	0	No
i_atmQF	8408	i1b (10)	10	N/A	0	No
i_timecorflg	8418	i2b	2	N/A	0	No
i_APIID_AvFlg	8420	i1b (8)	8	n/a	-127	No
i_AttFlg2	8428	i1b (20)	20	NA	0	no
i_spare5	8448	i1b	1	NA	0	NA
i_FrameQF	8449	i1b	1	N/A	0	No
i_OrbFlg	8450	i1b (2)	2	NA	0	no
i_rngCorrFlg	8452	i1b (2)	2	N/A	0	No
i_CorrStatFlg	8454	i1b (2)	2	NA	0	no
i_beam_coel ev	8456	i4b	4	degrees*100	0	i4b
i_beam_azimuth	8460	i4b	4	degrees*100	0	i4b
i_AttFlg1	8464	i2b	2	N/A	0	No
i_Spare6	8466	i1b (2)	2	N/A	null	No
i_DEM_hires_src	8468	i1b (40)	40	NA	0	No
i_DEM_hires_elv	8508	i2b (40)	80	meters	-500	i2b

Table B-7 GLA14 Record Format (Continued)

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned?	Invalid Value/Flag
i_satNdx	8588	i1b (40)	40	ns	0	i1b
i_satRngCorr	8628	i2b (40)	80	mm	0	i2b
i_satCorrFlg	8708	i1b (40)	40	NA	NA	No
i_satNrgCorr	8748	i2b (40)	80	mm	0	i2b
i_satPwdCorr	8828	i2b (40)	80	mm	0	i2b
i_gval_rcv	8908	i2b (40)	80	counts	0	i2b
i_RecNrgAll	8988	i2b (40)	80	0.01 fJoules	0	i_APID_AvFlag
i_FRir_cldtop	9068	i2b (40)	80	deka-meters	0	i2b
i_FRir_qaFlag	9148	i1b (40)	40	NA	0	No
i_FRir_ODflg	9188	i1b (40)	40	NA	0	No
i_FRir_intsig	9228	i2b (40)	80	e7/(m-sr)	0	i2b
i_msRngCorr	9308	i2b (40)	80	Unknown	0	i2b
i_msCorrFlg	9388	i1b (40)	40	Unknown	0	No
i_Surface_temp	9428	i2b	2	degrees Celsius * 100	-10000	i2b
i_Surface_press	9430	i2b	2	millibars of mercury * 10	0	i2b
i_Surface_relh	9432	i2b	2	percentage * 100	0	i2b
i_Spare7	9434	i1b (566)	566	NA	null	null
Total Bytes	10000					

B.1.9 GLA15 - Ocean Elevation

Each record contains 1 second of data.

Table B-8 GLA15 Record Format

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned?	Invalid Value/Flag
Record Type:GLA15_MAIN; % of Granule: 70; Record Duration (seconds):1; Repeats: 1						
Latest : Last Modified : Mon Sep 19 09:22:56 GMT-0400 (EDT) 2005						
i_rec_ndx	0	i4b	4	N/A	No	no
i_UTCTime	4	i4b (2)	8	seconds, microseconds	No	no
i_transtime	12	i2b	2	microseconds	No	i2b
i_Spare1	14	i1b (2)	2	N/A	No	No
i_deltagpstmcor	16	i4b	4	nanoseconds	No	gi_invalid_i4b
i_dShotTime	20	i4b (39)	156	microseconds	No	No
i_lat	176	i4b (40)	160	microdeg	No	i4b
i_lon	336	i4b (40)	160	microdeg	No	i4b
i_elev	496	i4b (40)	160	mm	No	i4b
i_PADPoint	656	i4b (6, 40)	960	Unitless*1000000	No	i4b
i_PODFixedPos	1616	i4b (6, 40)	960	3 * (m, mm)	No	i4b
i_sigmaatt	2576	i2b (40)	80	Unitless	No	i2b
i_Azimuth	2656	i4b	4	millideg	No	i4b
i_SolAng	2660	i4b	4	microdeg	No	i4b
i_tpintensity_avg	2664	i4b	4	counts	No	i4b
i_tpazimuth_avg	2668	i2b	2	degrees*10	No	i2b
i_tpeccentricity_avg	2670	i2b	2	Unitless*1000	No	i2b
i_tpmajoraxis_avg	2672	i2b	2	cm	No	i2b
i_Spare2	2674	i1b (2)	2	N/A	No	No
i_gdHt	2676	i2b (2)	4	cm	No	i2b

Table B-8 GLA15 Record Format (Continued)

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned?	Invalid Value/Flag
i_erElv	2680	i2b (2)	4	mm	No	i2b
i_spElv	2684	i2b (4)	8	mm	No	i2b
i_ldElv	2692	i2b (4)	8	mm	No	i2b
i_ocElv	2700	i2b (2)	4	mm	No	i2b
i_wTrop	2704	i2b (2)	4	mm	No	i2b
i_dTrop	2708	i2b (40)	80	mm	No	i2b
i_surfType	2788	i1b	1	N/A	No	No
i_Spare3	2789	i1b (3)	3	N/A	No	No
i_DEM_elv	2792	i4b (40)	160	cm	No	i4b
i_refRng	2952	i4b (40)	160	mm	No	i4b
i_TrshRngOff	3112	i4b (40)	160	mm	No	i4b
i_ocRngOff	3272	i4b (40)	160	mm	No	i4b
i_SigEndOff	3432	i4b (40)	160	mm	No	i4b
i_cntRngOff	3592	i4b (40)	160	mm	No	i4b
i_reflctUncorr	3752	i4b (40)	160	Unitless*1E06	No	i4b
i_reflCor_atm	3912	i4b	4	Unitless*1E06	No	i4b
i_maxSmAmp	3916	i2b (40)	80	Tenth of millivolts	No	No
i_SigmaElv	3996	i2b (40)	80	mm	No	i2b
i_numPk	4076	i1b (40)	40	N/A	No	No
i_skew2	4116	i2b (40)	80	unitless * 100	No	i2b
i_OcRufRMS	4196	i4b	4	mm	No	i4b
i_OcMeanElev	4200	i4b	4	mm	No	i4b
i_lowElev	4204	i4b (40)	160	mm	No	i4b
i_highElev	4364	i4b (40)	160	mm	No	i4b
i_OceanVar	4524	i2b (40)	80	millivolts	No	i2b
i_ElvuseFlg	4604	i1b (5)	5	N/A	No	No
i_atm_avail	4609	i1b	1	NA	No	No
i_erd	4610	i2b	2	Millimeters	No	i2b

Table B-8 GLA15 Record Format (Continued)

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned?	Invalid Value/Flag
i_rdu	4612	i2b	2	Millimeters	No	i2b
i_cld1_mswf	4614	i1b	1	NA	No	No
i_MRC_af	4615	i1b	1	NA	No	No
i_OcRMSqf	4616	i1b (40)	40	null	No	N
i_ElvFlg	4656	i1b (40)	40	N/A	No	No
i_rng_UQF	4696	i2b (40)	80	N/A	No	No
i_atmQF	4776	i1b (10)	10	N/A	No	No
i_timecorflg	4786	i2b	2	N/A	No	No
i_APIID_AvFlg	4788	i1b (8)	8	n/a	No	No
i_AttFlg2	4796	i1b (20)	20	NA	No	no
i_spare5	4816	i1b	1	NA	No	NA
i_FrameQF	4817	i1b	1	N/A	No	No
i_OrbFlg	4818	i1b (2)	2	NA	No	no
i_rngCorrFlg	4820	i1b (2)	2	N/A	No	No
i_CorrStatFlg	4822	i1b (2)	2	NA	No	no
i_beam_coel ev	4824	i4b	4	degrees*100	No	i4b
i_beam_azimuth	4828	i4b	4	degrees*100	No	i4b
i_AttFlg1	4832	i2b	2	N/A	No	No
i_Spare6	4834	i1b (2)	2	N/A	No	No
i_satNdx	4836	i1b (40)	40	ns	Yes	i1b
i_satRngCorr	4876	i2b (40)	80	mm	No	i2b
i_satCorrFlg	4956	i1b (40)	40	NA	NA	No
i_satNrgCorr	4996	i2b (40)	80	mm	No	i2b
i_satPwdCorr	5076	i2b (40)	80	mm	No	i2b
i_gval_rcv	5156	i2b (40)	80	counts	No	i2b
i_RecNrgAll	5236	i2b (40)	80	0.01 fJoules	No	i_APIID_AvFlg
i_FRir_cldtop	5316	i2b (40)	80	deka-meters	No	i2b

Table B-8 GLA15 Record Format (Continued)

Product Var Name	Offset (Bytes)	Product Data Type	Total Bytes	Product Units	Is Unsigned?	Invalid Value/Flag
i_FRir_qaFlag	5396	i1b (40)	40	NA	No	No
i_FRir_ODflg	5436	i1b (40)	40	NA	No	No
i_FRir_intsig	5476	i2b (40)	80	e7/(m-sr)	No	i2b
i_msRngCorr	5556	i2b (40)	80	Unknown	No	i2b
i_msCorrFlg	5636	i1b (40)	40	Unknown	No	No
i_Surface_temp	5676	i2b	2	degrees Celsius * 100	No	i2b
i_Surface_press	5678	i2b	2	millibars of mercury * 10	No	i2b
i_Surface_relh	5680	i2b	2	percentage * 100	No	i2b
i_Surface_wind	5682	i2b	2	meters/second * 100	No	i2b
i_Surface_wdir	5684	i2b	2	degrees * 10	No	i2b
i_Spare7	5686	i1b (594)	594	N/A	No	No
Total Bytes	6280					

Abbreviations & Acronyms

A2P	Algorithm-to-Product Conversion
ALT	Altimeter or Altimetry, also designation for the EOS-Altimeter spacecraft series
ANCxx	GLAS Ancillary Data Files
APID	GLAS Level-0 Data file
ATBD	Algorithm Theoretical Basis Document
ATM	Atmosphere
CCB	Change Control Board
ClearCase	GSAS version tracking software
CR	Change Request
DAAC	Distributed Active Archive Center
DEM	Digital Elevation Model
DFD	Data Flow Diagram
DLT	Digital Linear Tape
EDOS	EOS Data and Operations System
EDS	Expedited Data Set
ELEV	Elevation
EOC	EOS Operating Center
EOS	NASA Earth Observing System Mission Program
EOSDIS	Earth Observing System Data and Information System
GB	Gigabyte
GDS	GLAS Ground Data System
GLAS	Geoscience Laser Altimeter System instrument or investigation
GLAxx	GLAS Science Data Product Files
GLOP	GLAS Level-0 PGE (correctly called GLAS_L0proc)
GPS	Global Positioning System
GSAS	GLAS Science Algorithm Software
GSFC	NASA Goddard Space Flight Center at Greenbelt, Maryland
GSFC/WFF	NASA Goddard Space Flight Center/Wallops Flight Facility at Wallops Island, Virginia
TBD	to be determined, to be done, or to be developed

Glossary

aggregate	A collection, assemblage, or grouping of distinct data parts together to make a whole. It is generally used to indicate the grouping of GLAS data items, arrays, elements, and EOS parameters into a data record. For example, the collection of Level 1B EOS Data Parameters gathered to form a one-second Level 1B data record. It could be used to represent groupings of various GLAS data entities such as data items aggregated as an array, data items and arrays aggregated into a GLAS Data Element, GLAS Data Elements aggregated as an EOS Data Parameter, or EOS Data Parameters aggregated into a Data Product record.
array	An ordered arrangement of homogenous data items that may either be synchronous or asynchronous. An array of data items usually implies the ability to access individual data items or members of the array by an index. An array of GLAS data items might represent the three coordinates of a georeference location, a collection of values at a rate, or a collection of values describing an altimeter waveform.
file	A collection of data stored as records and terminated by a physical or logical end-of-file (EOF) marker. The term usually applies to the collection within a storage device or storage media such as a disk file or a tape file.
header	A text and/or binary label or information record, record set, or block, prefacing a data record, record set, or a file. A header usually contains identifying or descriptive information, and may sometimes be embedded within a record rather than attached as a prefix.
item	Specifically, a data item. A discrete, non-decomposable unit of data, usually a single word or value in a data record, or a single value from a data array. The representation of a single GLAS data value within a data array or a GLAS Data Element.
label	The text and/or binary information records, record set, block, header, or headers prefacing a data file or linked to a data file sufficient to form a labeled data product. A label may consist of a single header as well as multiple headers and markers depending on the defining authority.
Level 0	The level designation applied to an EOS data product that consists of raw instrument data, recorded at the original resolution, in time order, with any duplicate or redundant data packets removed.
Level 1A	The level designation applied to an EOS data product that consists of reconstructed, unprocessed Level 0 instrument data, recorded at the full resolution with time referenced data records, in time order. The data are annotated with ancillary information including radiometric and geometric calibration coefficients, and georeferencing parameter data (i.e., ephemeris data). The included, computed coefficients and parameter data have not however been applied to correct the Level 0 instrument data contents.
Level 1B	The level designation applied to an EOS data product that consists of Level 1A data that have been radiometrically corrected, processed from raw data into sensor data units, and have been geolocated according to applied georeferencing data.

Level 2	The level designation applied to an EOS data product that consists of derived geophysical data values, recorded at the same resolution, time order, and georeference location as the Level 1A or Level 1B data.
Level 3	The level designation applied to an EOS data product that consists of geophysical data values derived from Level 1 or Level 2 data, recorded at a temporally or spatially resampled resolution.
Level 4	The level designation applied to an EOS data product that consists of data from modeled output or resultant analysis of lower level data that are not directly derived by the GLAS instrument and supplemental sensors.
metadata	The textual information supplied as supplemental, descriptive information to a data product. It may consist of fixed or variable length records of ASCII data describing files, records, parameters, elements, items, formats, etc., that may serve as catalog, data base, keyword/value, header, or label data. This data may be parsable and searchable by some tool or utility program.
orbit revolution	The passage of time and spacecraft travel signifying a complete journey around a celestial or terrestrial body. For GLAS and the EOS ICESat spacecraft each orbit revolution count starts at the time when the spacecraft is on the equator traveling toward the North Pole, continues through the equator crossing as the spacecraft ground track moves toward the South Pole, and terminates when the spacecraft has reached the equator moving northward from the South Polar region.
parameter	Specifically, an EOS Data Parameter. This is a defining, controlling, or constraining data unit associated with a EOS science community approved algorithm. It is identified by an EOS Parameter Number and Parameter Name. An EOS Data Parameter within the GLAS Data Product is composed of one or more GLAS Data Elements
pass	A sub-segment of an orbit, it may consist of the ascending or descending portion of an orbit (e.g., a descending pass would consist of the ground track segment beginning with the northernmost point of travel through the following southernmost point of travel), or the segment above or below the equator (e.g., either the northern or southern hemisphere portion of the ground track on any orbit).
product	Specifically, the Data Product or the EOS Data Product. This is implicitly the labeled data product or the data product as produced by software on the DAAC or SCF. A GLAS data product refers to the data file or record collection either prefaced with a product label or standard formatted data label or linked to a product label or standard formatted data label file. Loosely used, it may indicate the entire set of product files contained in a data repository.
record	A specific organization or aggregate of data items. It represents the collection of EOS Data Parameters within a given time interval, such as a one-second data record. It is the first level decomposition of a product file.
Standard Data Product	Specifically, a GLAS Standard Data Product. It represents an EOS ICESat/ GLAS Data Product produced on the DAAC or on the SCF. It is routinely produced and is intended to be archived in the EOSDIS data repository for EOS user community-wide access and retrieval.
variable	Usually a reference in a computer program to a storage location.
